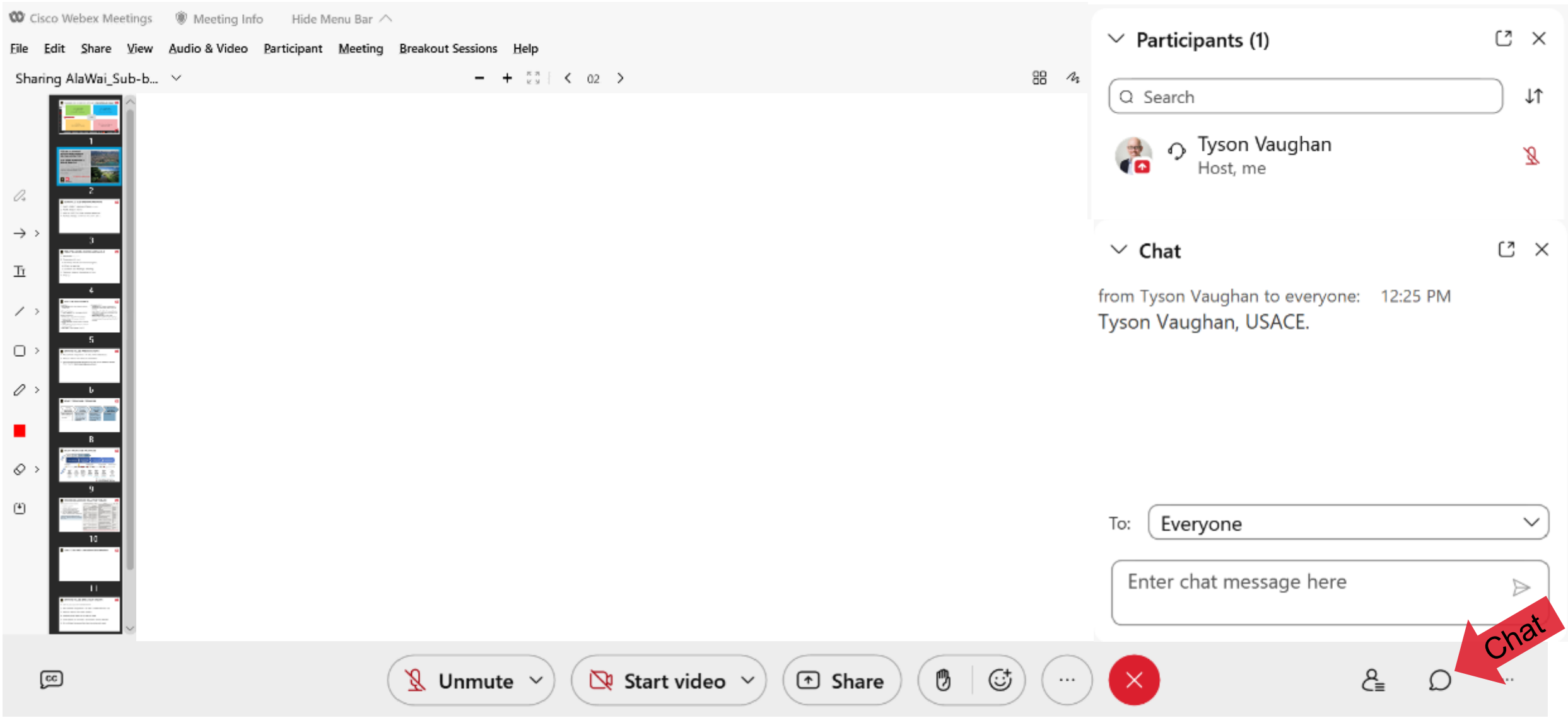
# WELCOME! WHO DO WE HAVE WITH US?



# ALA WAI FLOOD RISK MANAGEMENT GENERAL RE-EVALUATION STUDY

## SUB-BASIN WORKSHOP 1: MAKIKI & PALOLO


Eric Tessmer (2017)

US Army Corps of Engineers (USACE)
City and County of Honolulu (CCH)

1 April 2022

*This session is being recorded.


Cory Lum, *Civil Beat* (2015)

U.S.ARMY

US Army Corps of Engineers®

# SCHEDULE: SUB-BASIN WORKSHOPS

1. April 1, 2022 (F): Makiki and Palolo Sub-basins ← You are here!
2. April 8, 2022 (F): Manoa Sub-basin
3. April 14, 2022 (Th): Ala Wai Canal and Lower Watershed
4. April 22, 2022 (F): Continued discussion, Q & A

# TODAY'S AGENDA: MAKIKI AND PALOLO

1. Introduction ← You are here!
2. Presentation (20 min)
   a) Summary of study process and progress;
   b) Where we are now, for each sub-basin;
   c) Questions and challenges remaining;
3. Facilitated breakout discussions (45 min)
4. Wrap-up

# HOSTS & DISCUSSANTS

*Presenters (USACE):*
- **Cindy Acpal**, Project Manager
- **Eric Merriam**, PhD, PMP; Planner; *Study Lead*

*MC / Lead Facilitator (USACE):*
- **Tyson Vaughan**, PhD; Sociologist

*Additional Facilitators (USACE):*
- **Kelley Philbin**, PE; Engineer; *Technical Lead*
- **Ben Reder**, Project Manager

*Discussant (USACE):*
- **Jeffrey Herzog**, Deputy Chief, Civil and Public Works

*Discussants (CCH):*
- **Alex Kozlov**, PE; Director, Department of Design and Construction, City & County of Honolulu
- **Haku Milles**, PE, LEED AP; Deputy Director, Department of Design and Construction, City & County of Honolulu
- **Matthew Gonser**, AICP, CFM; Chief Resilience Officer, Office of Climate Change, Sustainability and Resiliency, City & County of Honolulu

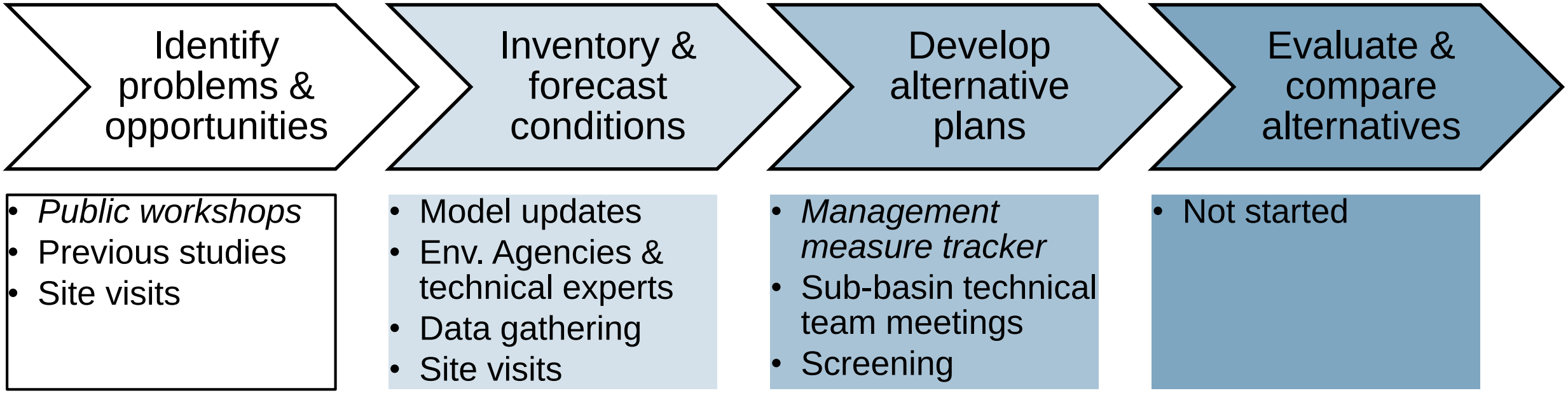
# GROUND RULES: PRESENTATION

1. Post comments and questions in the chat, or hold until breakouts.

2. Keep your audio on mute during the presentation.

3. If you are having technical difficulties, let us know via the chat and/or email to Tyson Vaughan: Earl.T.Vaughan@usace.army.mil.

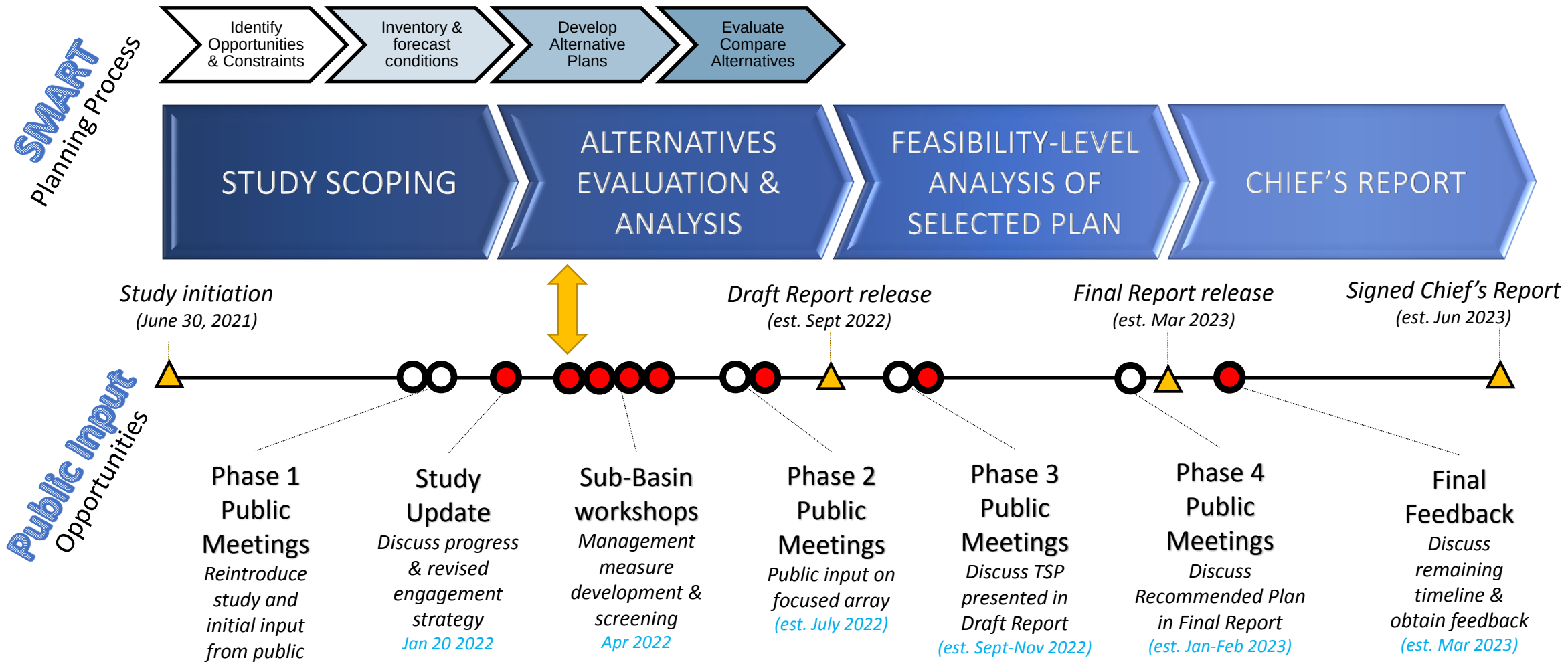
# STUDY PROCESS & PROGRESS




**Progress Since Last Public Information Meeting:**

- Hydrologic & hydraulic model updates and calibration
- Completed sub-basin management measure development meetings
- Initial round of management measure screening (ongoing)
- Technical team site visit from March 21-24

# STUDY PROCESS & PROGRESS



# MANAGEMENT MEASURE TRACKER

Management measure tracker:

- Available at:

  https://www.honolulu.gov/alawai/resources.html

- Updated prior to public meeting
- Focused, real-time feedback on technical & planning process

204 measures being tracked

- 48 screened from further consideration
- 156 still under consideration

Meetings will not cover all measures

Analyses will be ongoing & updated in tracker

**Ala Wai Flood Risk Management GR Study - Management Measure Tracking Spreadsheet**

*last updated: March 31, 2022*

| Tracking # | Measure Name | Location | Description | Status | Notes/Rationale |
|---|---|---|---|---|---|
| 1 | Flap gates on storm drains | Ala Wai Blvd. between Kalakaua and Ala Moana Blvd. | During high tide Ala Wai Blvd. between Kalakaua and the cul de sac ending at Ala Moana Blvd. floods. Ala Wai canal in this area needs flap gates to keep Ala Wai Canal water from flooding storm drains and flooding streets. | Under consideration | Provision, modification, and/or maintenance of drainage systems to capture and convey interior runoff in urban areas is a non-Federal responsibility and therefore cannot be included in a recommendation made as a result of this general reevaluation report. However, this study can make modifications to natural stream channels or previously modified natural waterways that help reduce backup within adjacent drainage systems. |
| 2 | Elevate canal walls | Ala Wai Canal | Increase canal capacity by elevating the existing canal floodwalls | Under consideration | |
| 3 | Deepen the canal | Ala Wai Canal | Excavate to deepen the existing canal and stabilize existing floodwalls. | Screened Out | Dredging to the maintenance elevation is encouraged for the City to maintain consistently. Deepening the canal further than the maintenance elevation is generally not recommended due to the stability of canal walls and slope stability. Increasing storage of the canal can technically reduce flooding but not without instability of the structural components of the bridges and canal walls. The integrity of the canal walls as-is would not withstand excavation - only replacing with an entirely new system would. Further analysis is needed to determine the stability of bridge pier and footings. See measure 5. |
| 4 | Deepen canal for periodic pump drainage | Ala Wai Canal | Dig existing walls deeper to turn the canal into a periodic pump drainage to address inundation by all three sources of flooding | Screened Out | Digging the existing walls deeper is not recommended due to their strucutral integrity. Pumping the canal to increase storage capacity is not recomended due to stability of the existing canal walls. Hydrostatic pressure is likely needed for structural stability. Technical analysis needed to determine structural stability of bridge piers and footings. See measure 5. |
| 5 | Deepen the canal, replace canal walls with higher flood protection | Ala Wai Canal | Dredge canal down to its original depth of 15' to 25', and replace the degraded infrastructure with new canal walls that are set for greater flood protection | Under consideration | The integrity of the canal walls as-is would not withstand greater dredging efforts than maintence dredging - only replacing with an entirely new system would. Further analysis is needed to determine the appropriate wall height, the stability of bridge pier and footings, and the optimal depth that balances slope stability and flood storage. |
| 6 | Widen canal | Ala Wai Canal | Widen the canal to provide greater flow and storage capacity. | Under consideration | Widening the canal in strategic locations, namely at the Eastern end of the canal, could provide more flood storage. Further analysis is needed. Widening the canal for the entire length would require extensive real estate acquisitions with significant costs. Expanding canal storage through the use of floodwalls and/or utilizing existing storage areas along the canal (e.g., golf course, Ala Wai Community Park) are likely more efficient and are considered elsewhere. |
| 7 | Dredge Ala Wai Canal to original depth | Ala Wai Canal | Dredge canal down to its original depth of 15' to 25' since current dredging only goes down to 12'. | Screened Out | Dredging to the maintenance elevation is encouraged for the City to maintain consistently. Deepening the canal further than the maintenance elevation is generally not recommended due to the stability of canal walls and slope stability. Increasing storage of the canal can technically reduce flooding but not without instability of the structural components of the bridges and canal walls. The integrity of the canal walls as-is would not withstand excavation - only replacing with an entirely new system would. Further analysis is needed to determine the stability of bridge pier and footings. See measure 5. |
| 8 | Dredge Manoa-Palolo | Manoa-Palolo Channel | Dredge the Manoa-Palolo channel | Under consideration | |
| 9 | Canal clean ups | Ala Wai Canal | Involve the community to conduct regular clean ups | Screened Out | Organizing clean-ups is outside the scope of the current study. Community involvement for clean ups after construction is a possibility; however, those initiatives those initiatives need to be initiated by other entities. |
| 10 | Effective Microorganisms (EM) to eliminate sludge | Ala Wai Canal | Use "genki balls" to clean up and eliminate sludge in the canal. These healthy microorganisms work to digest sludge in the canal which will help not only to evacuate water from the canal quicker, but also restore the ecosystem and reduce frequency for dredging. | Screened Out | Sludge eliminated by the genki balls would have to be extensive enough to reduce flood risk in order to be justified under the current study. Genki balls would eliminate the organic matter within the canal, which only makes up a small portion of material within the canal. Genki balls as a standalone measure would not provide enough reduction in material to increase storage capacity of the canal and reduce flood waters. Genki balls could be incorporated into a separate effort focused on ecosystem restoration. |
| 11 | Oysters to clean the canal | Ala Wai Canal | Use oysters as filters to clean the canal waters. | Screened Out | Improving water quality is outside the scope of this project. |
| 12 | Debris management | Watershed wide | Better manage the debris that ends up in the canal | Under consideration | Debris management will likely be most effective when utilized in conjunction with other measures (e.g., combined storage/debris management basins; structural modifications to bridges). |
| 13 | Submersible pumps | Ala Wai Canal | Use underwater pumps to create a lower profile pumping station | Under consideration | |
| 14 | Miter gates | Ala Wai Canal | Use several smaller radius miter gates to minimize visual impacts (to be used in conjunction with pump station) | Under consideration | |
| 15 | Lowered gate structure | Ala Wai Canal | Use a lowered structure underwater that could be raised in an event instead of a miter dam. (to be used in conjunction with pump station) | Under consideration | |
| 16 | Retractable flood barriers | Ala Wai Canal | Relocate pump station to the golf course. Use a series of retractable flood barriers that would allow for 4 rowing lanes (44' wide) across the width of the canal. | Under consideration | |

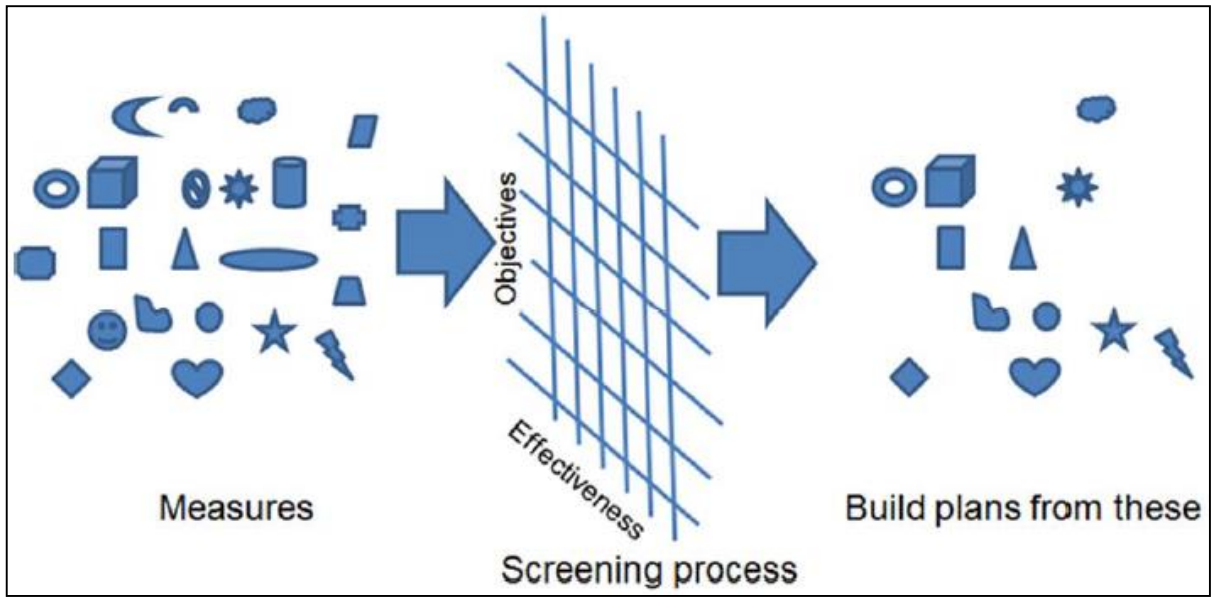
*NOTE: Only displaying measures 1-16 of 204 total.*

# MEASURE SCREENING: PROCESS

## Iteration 1 (Complete)

Screening criteria:

- Study Authority – Is it within study authority?
- Technical Feasibility – Is it technically feasible?
  - Existing data and conditions, engineering standards and best practices




## Iteration 2 (Ongoing)

Screening/tiering criteria:

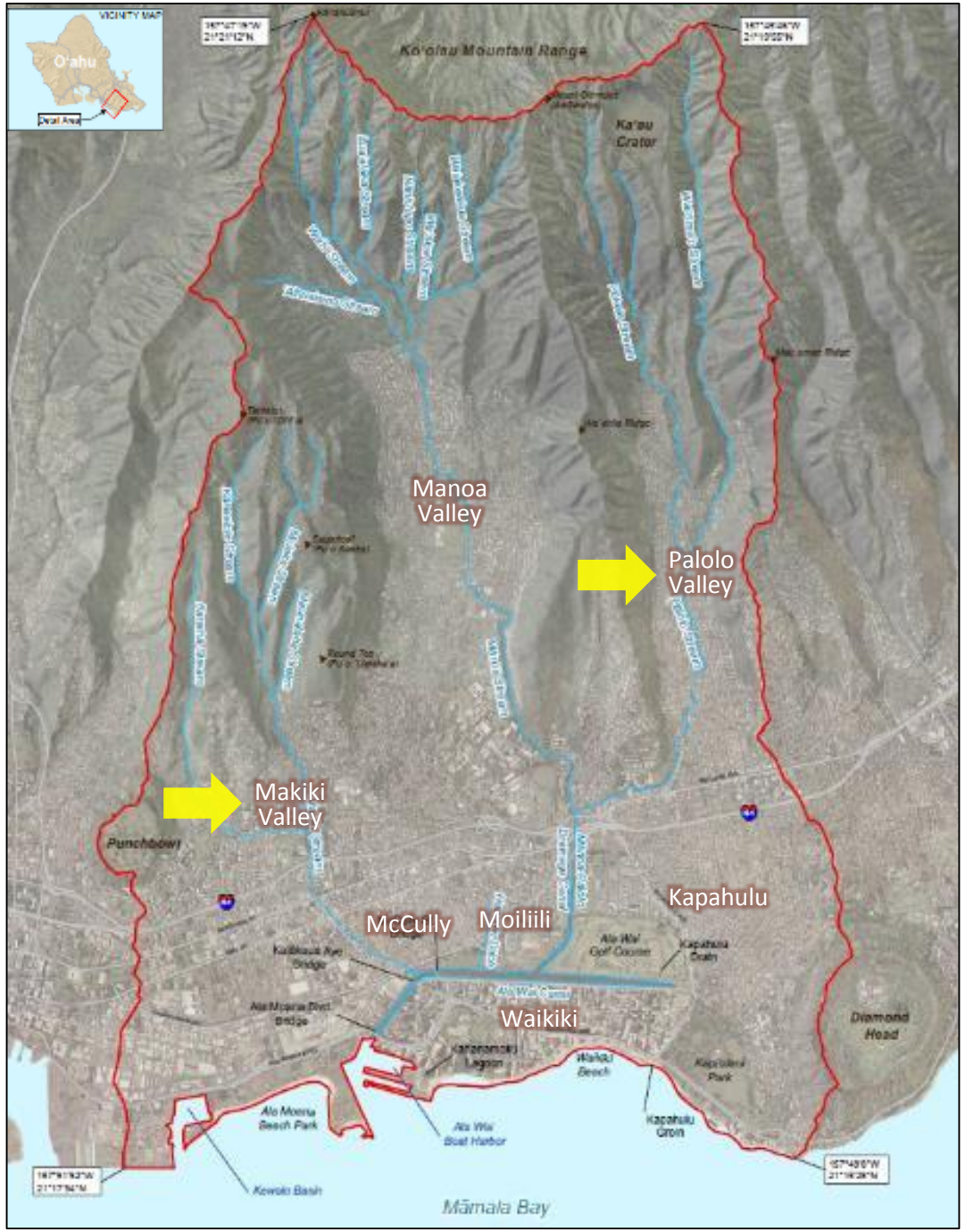
- Effectiveness – Extent it would reduce life risk and/or economic damages.
- Efficiency – Expected cost-effectiveness.
- Environmental Considerations – Benefits/impacts.

Existing models/data: water volumes, expected damages, high-level costs

Tiering to prioritize analyses:

- Tier 1: Highest analytical priority. Results could screen other measures.
- Tier 2: Assessed after Tier 1 measures.
- Tier 3: Assessed after Tier 2 measures.

*Not a hierarchy of importance. Allows team to maximize efficiency. All measures will be assessed.*


Ko'olau Mountain Range
Ka'au Crator
Manoa Valley
Palolo Valley
Makiki Valley
Punchbowl
McCully
Moiliili
Kapahulu
Waikiki
Diamond Head
Ala Moana Beach Park
Ala Wai Boat Harbor
Kapahulu Groin
Kewalo Basin
Māmala Bay

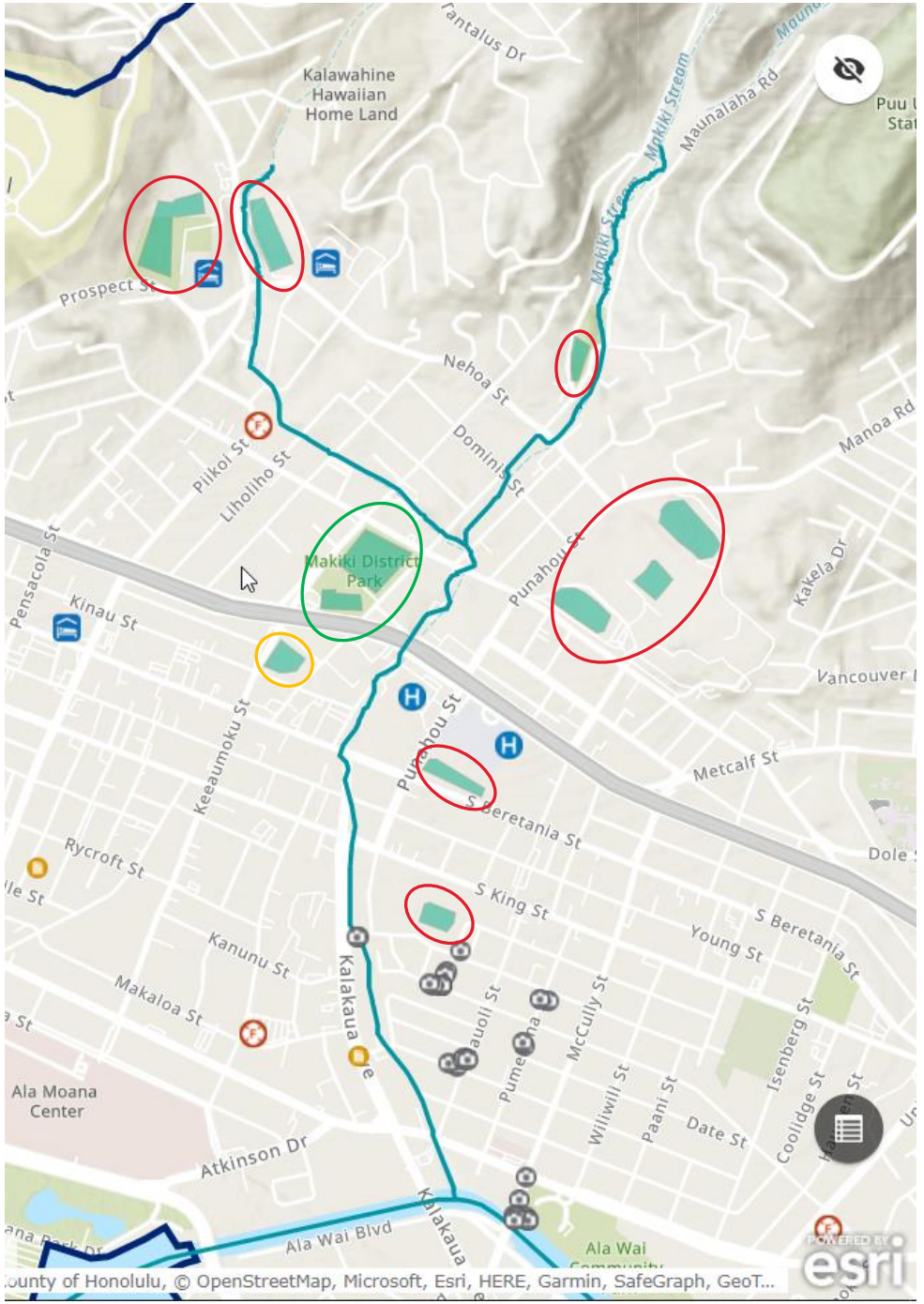
# MAKIKI & PALOLO NONSTRUCTURAL, NATURAL & NATURE-BASED

| No. | Measure Name | Notes | Status / next steps |
|---|---|---|---|
| 65<br>91<br>92 | Forest/Invasive Management | Modeling will be conducted to quantify the extent to which forest management reduces downstream flood risk. | Tier 1 for hydrologic modeling |
| 104 | Decrease imperviousness | Modeling will be conducted to quantify the extent to which decreasing impervious surfaces throughout the watershed reduces downstream flood risk. | Tier 1 for hydrologic modeling |
| 184 | Nonstructural measures | Potential for nonstructural measures (e.g., elevation, floodproofing, relocation, flood warning systems) will be assessed once economic models are finalized. | Tier 1 for economic modeling |
| 96<br>97<br>188 | Debris Management | Modeling to assess potential problem areas for debris buildup will be completed first. Specific debris management measures will then be identified. | Under consideration |
| 83<br>112<br>114<br>124 | Wetlands, agriculture | Storage requirements and potential will be modeled initially. Potential for incorporation of wetlands and or agricultural features will then be assessed. | Under consideration |

‘Under consideration’ indicates that it has not yet been assessed under the second screening iteration to-date.


# MAKIKI MEASURES: STRUCTURAL

| No. | Measure Name | Notes | Status |
|---|---|---|---|
| 138 | Makiki District Park Detention | Large storage area with direct access from Kanaha stream. Could leverage existing infrastructure. | Tier 1 |
| 139 | Cartwright Neighborhood Park Detention | Small storage size and distance from stream limit potential effectiveness and efficiency. However, could be combined with Makiki District Park. | Tier 3 |
| 135 | Stevenson Middle School Playing Fields Detention | Unlikely to capture significant flows. Engineering challenges with large elevation difference between stream and field. | Screened |
| 136 | Roosevelt High School Football Fields Detention | Unlikely to capture significant flows. Engineering challenges with large elevation difference between stream and field. | Screened |
| 137 | Archie Baker Park Detention | Unlikely to capture significant flows. Engineering challenges with large elevation difference between stream and park. | Screened |
| 142 | Punahou School Detention | Elevation changes in the area and distance from stream limit effectiveness and efficiency. | Screened |
| 140 | Central Union Church Lot Detention | Small storage size and distance to stream limit potential effectiveness and efficiency. | Screened |
| 141 | Washington Middle School Detention | Small storage size and distance to stream limit potential effectiveness and efficiency. | Screened |
| 144 | Ala Moana Park Underground Storage | Underground Storage in conjunction with Bypass measure; storage not expected to be an efficient measure otherwise | Unassessed |



Top Left: Archie Baker Park

Top Right: Roosevelt High School Field

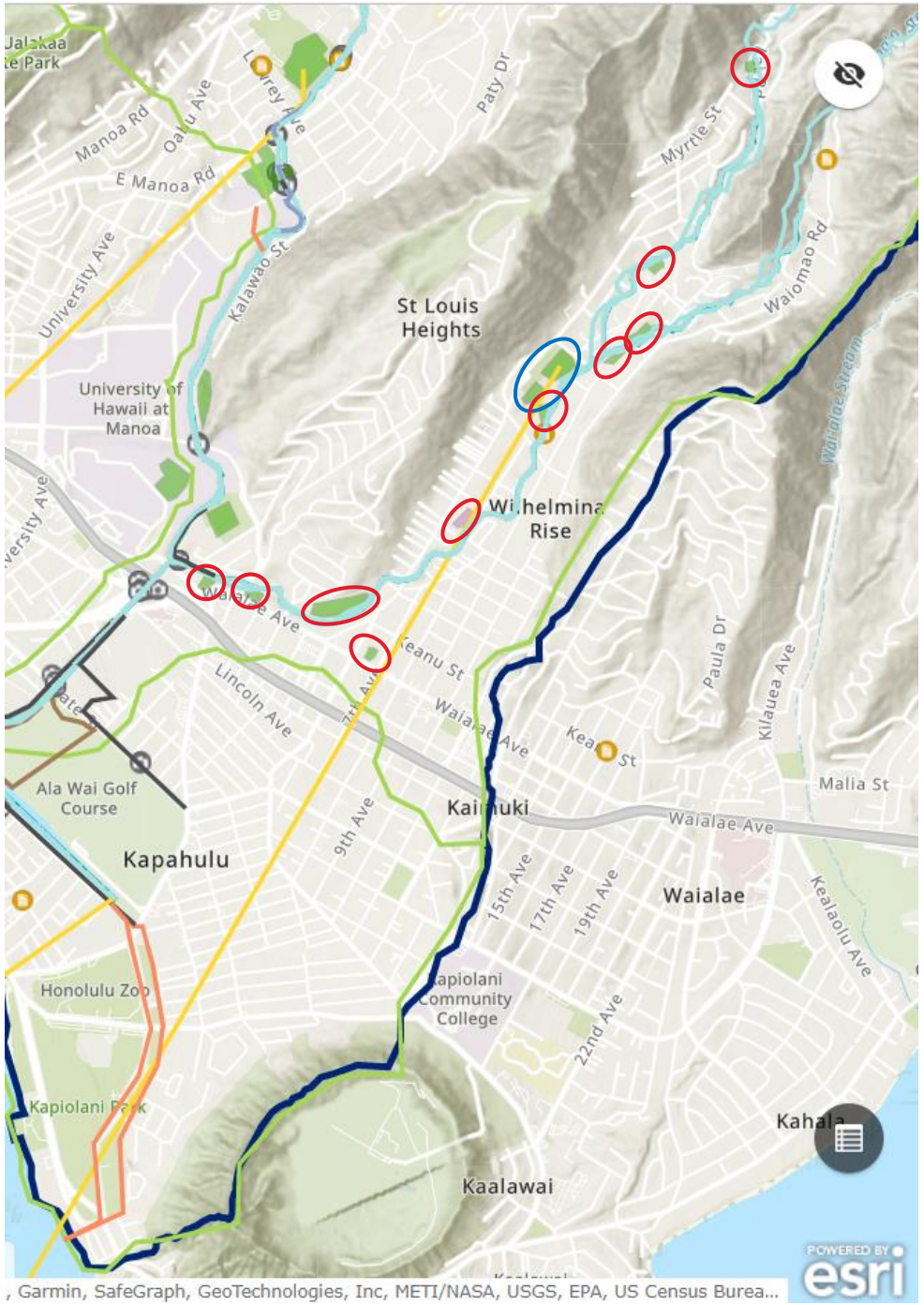
Bottom Left: Makiki District Park

# MAKIKI MEASURES: STRUCTURAL CONT.

| No. | Measure Name | Notes | Status |
|---|---|---|---|
| 130 | Piikoi Bypass | Utilize existing storm sewer to route water from Kanaha Stream to Ala Moana Park. Once Tier 1 measures are modeled, there will be a better understanding of the flows that would impact this measure. | Tier 2 |
| 131 | Pensacola Bypass | Utilize existing storm sewer to route water from Kanaha Stream to Ala Moana Park. Once Tier 1 measures are modeled, there will be a better understanding of the flows that would impact this measure. | Tier 2 |
| 132 | Ke'eaumoku Bypass | Utilize existing storm sewer to route water from Kanaha Stream to Ala Moana Park. Once Tier 1 measures are modeled, there will be a better understanding of the flows that would impact this measure. | Tier 2 |
| 133 | Young Bypass | Utilize existing storm sewer to route water from Makiki Stream to Ala Wai Harbor. Once Tier 1 measures are modeled, there will be a better understanding of the flows that would impact this measure. | Tier 2 |
| 134 | Makiki Tunnel System | Several considerations, including updating costs, real estate acquisitions, and environmental impacts. | Tier 3 |
| 63 | Makiki Stream Conduit | Put a conduit under the stream that outlets directly to the canal. Considerable infrastructure and cost requirements. Modeling team will initially focus on using existing infrastructure. | Tier 3 |
| 145 | Modify bridges | Modify bridges at constrictions - will need hydraulic results to identify pinch points | Under consideration |
| 64 | Modify Makiki entry angle | Changing entry angle would likely reduce backwater flooding. | Under consideration |
| 143 | Daylight streams | Daylight streams at constrictions - will need hydraulic results to identify pinch points | Under consideration |

# PALOLO MEASURES: STRUCTURAL

| No. | Measure Name | Notes | Status |
|---|---|---|---|
| 85<br>150 | Palolo Park Detention basin | Technical challenges due to elevation difference between park and stream. Adjacent publicly owned land could be used. Additional technical assessment and conceptual designs are required prior to modeling. | Tier 2 |
| 154 | Lā-ʻī Rd Detention Pond | Small storage size and elevation difference between stream and storage area limit effectiveness/efficiency. | Screened |
| 153 | Kula Kaiapuni ʻO Ānuenue Detention Pond | Small storage size and elevation difference between stream and field limit effectiveness/efficiency. | Screened |
| 152 | Pālolo Valley Homes Detention Pond | Small storage size and elevation difference between stream and storage area limit effectiveness/efficiency. | Screened |
| 151 | Pālolo Elementary School Detention Pond | Small storage size and elevation difference between stream and field limit effectiveness/efficiency. | Screened |
| 149 | William P. Jarrett Middle School Detention Pond | Small storage size and elevation difference between stream and field limit effectiveness/efficiency. | Screened |
| 148 | Aliʻiolani Elementary School Detention Pond | Small storage size and location limit effectiveness. | Screened |
| 162 | Chaminade University Playing Field Underground Storage | Engineering challenges with large elevation difference between stream and field limit efficiency. | Screened |
| 156 | City Mill Parking Lot Detention Pond | Small storage size limits effectiveness. | Screened |
| 155 | Public Storage Parking Lot Detention Pond | Small storage size limits effectiveness. | Screened |
| 163 | Pālolo Valley District Park Underground Storage | Underground detention structure below park | Under consideration |
| 158 | Permeable Pavement System at Public Storage Parking Lot | Replace parking lot with permeable pavement to reduce direct runoff above the confluence | Under consideration |
| 159 | Permeable Pavement System at City Mill Parking Lot | Replace parking lot with permeable pavement to reduce direct runoff above the confluence | Under consideration |
| 160 | Permeable Pavement System at Pālolo Hongwanji Mission | Replace parking lot with permeable pavement to reduce direct runoff | Under consideration |

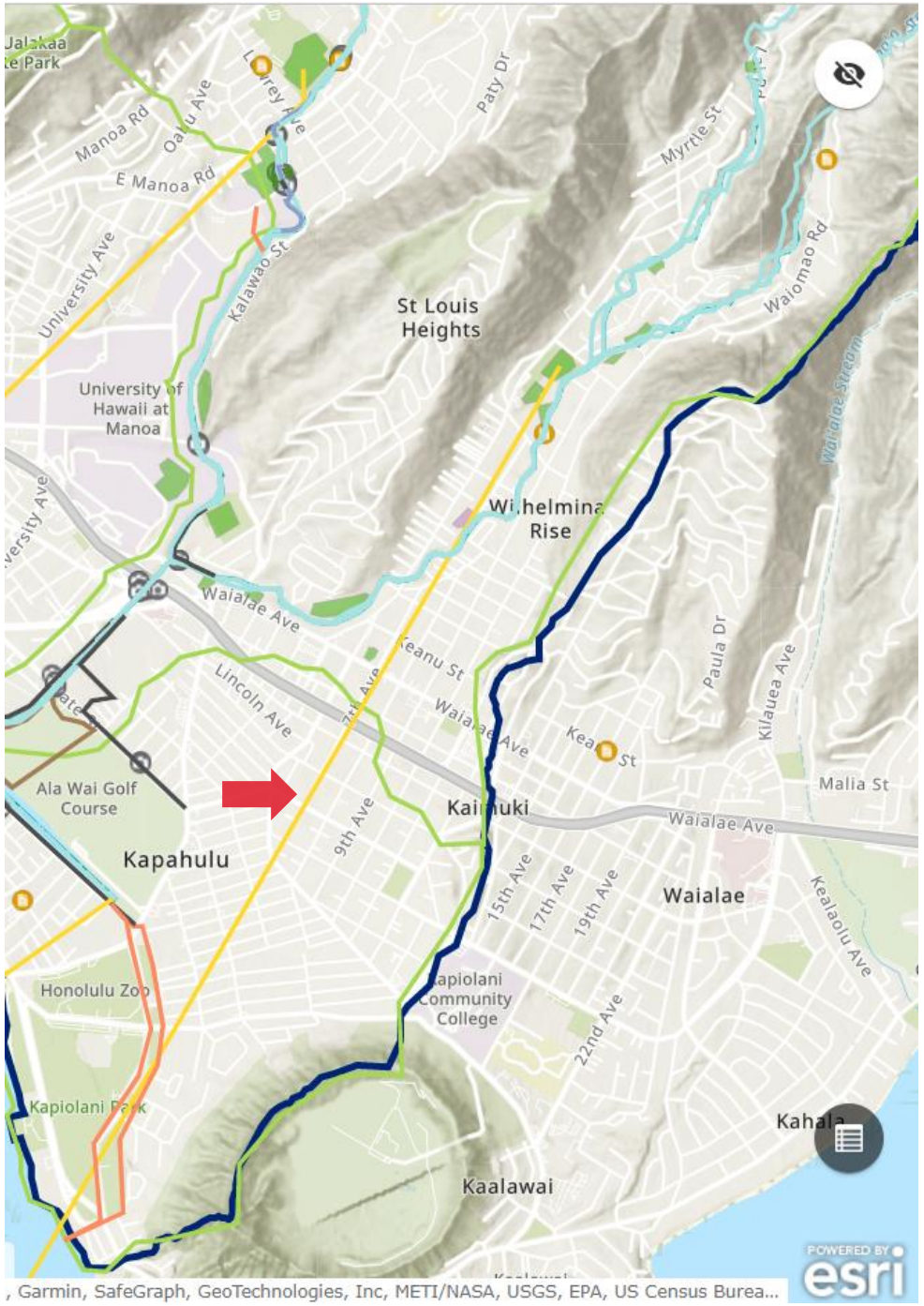


Left: Palolo Valley District Park

Top: St. Louis School Football Field

# PALOLO MEASURES: STRUCTURAL CONT.

| No. | Measure Name | Notes | Status |
|---|---|---|---|
| 161 | Palolo Tunnel System | Several considerations, including updating costs, real estate acquisitions, and environmental impacts. | Tier 3 |
| 157 | Palolo Stilling Basin(s) | Stilling Basin to dissipate energy and reduce velocities from channelized stream - will need hydraulic results to identify areas of high velocities with minimal upstream impacts | Under consideration |
| 145 | Modify bridges | Modify bridges at constrictions - will need hydraulic results to identify pinch points | Under consideration |
| 146 | Palolo Channel Modification | Deepen channel to provide more within-bank storage; can be used in conjunction with channel naturalization | Under consideration |
| 82 147 | Palolo Channel Naturalization | Return channel to a more natural state by removing concrete and adding natural slope material. | Under consideration |



Palolo Stream at Paalea St Bridge

# DISCUSSION GROUPS

**Webex main room.** (here)
Facilitator: Ben Reder

**Makiki discussion group**.
Facilitators: Tyson Vaughan and Kelley Philbin (technical lead)

**Palolo discussion group.**
Facilitators: Eric Merriam (study lead) and Cindy Acpal (project manager)

# QUESTIONS FOR YOU

- What questions do you have about the screening process?
- What questions do you have about specific measures described today?
- What questions do you have about other measures not mentioned yet?
- Have we captured measures appropriately thus far?
- Are we still missing any additional measures for these sub-basins?
- Also: We seek additional information on the effects of lo'i kalo / taro farming (measure No. 83) on flooding. Can you help?

# GROUND RULES: DISCUSSION GROUPS

1. Join the group you are most interested in.
2. Post comments and questions in the chat or use the “raise hand” tool.
3. Keep your audio on mute unless speaking.
4. Introduce yourself briefly the first time you speak.
5. When speaking, be conscious of acronyms and technical language.
6. Be mindful and help ensure that others have a chance to speak.

# MAHALO

Thank you for your participation!  Please stay engaged:

- Email the project team: AlaWai@Honolulu.gov.
- Post more ideas on Crowdsource Reporter! (until April 30) https://lrp.maps.arcgis.com/apps/CrowdsourceReporter/index.html?appid=df9e77cff6454945ad3dc75716a044ec
- Check the project website: https://www.honolulu.gov/AlaWai.
  - Sign up for additional meeting notifications
  - Updated management measure tracker
  - Updated FAQs
  - Comment form
  - Link to Crowdsource Reporter